

## CLAIMS

We claim:

1. An apparatus for extracting a signal of interest from a plurality of spectrally and temporally overlapping input signals containing digital data having a bit rate, said input signals having carrier frequencies, said input signals having conjugate cycle frequencies equal to twice their carrier frequencies plus and minus one-half of their data bit rate, said input signals exhibiting conjugate spectral redundancy for spectral components having frequencies separated by said conjugate cycle frequencies, said input signals exhibiting temporal redundancy, said apparatus comprising:

- (a) time-shifting means for producing a time-shifted output signal wherein said signal of interest is time-shifted;
- (b) frequency-shifting means for producing a frequency-shifted output signal wherein said signal of interest is frequency-shifted by an amount determined by its cycle frequencies; and
- (c) linear combining means for weighting and summing said output signals to produce an estimate of said signal of interest.

2. An apparatus as recited in claim 1, wherein said input signals having real and imaginary components, and further comprising polarized switching means for producing a polarized output signal wherein said real and/or imaginary

components of said signal of interest are selected or deselected and wherein said real and imaginary components have signs which are changed or unchanged by said polarized switching means, wherein said polarized output signal is time-shifted, and wherein said polarized output signal is weighted and summed by said linear combining means.

3. An apparatus as recited in claim 1, further comprising receiving means for receiving said plurality of spectrally and temporally overlapping input signals.

4. An apparatus as recited in claim 1, further comprising demodulator means for extracting data from said estimate of said signal of interest.

5. An apparatus for extracting a signal of interest from a plurality of spectrally and temporally overlapping communications signals, said communications signals having real and imaginary components, said communications signals having carrier frequencies, said communications signals containing digital data having a bit rate, said communications signals exhibiting temporal redundancy, said communications signals having conjugate cycle frequencies equal to twice their carrier frequencies plus and minus one-half of their data bit rate, said communications signals exhibiting conjugate spectral

redundancy for spectral components having frequencies separated by said conjugate cycle frequencies, said apparatus comprising:

(a) time-shifting means for producing a time-shifted output signal wherein said signal of interest is time-shifted;

5 (b) polarized switching means for producing a polarized output signal wherein said real and/or imaginary components of said signal of interest are selected or deselected and wherein said real and imaginary components have signs which are changed or unchanged by said polarized switching means;

(c) frequency-shifting means for producing a frequency-shifted output  
10 signal wherein said signal of interest is frequency-shifted by an amount determined by its cycle frequencies; and

(d) linear combining means for weighting and summing said output signals to produce an estimate of said signal of interest.

15 6. An apparatus as recited in claim 5, further comprising receiving means for receiving said plurality of spectrally and temporally overlapping communications signals.

7. An apparatus as recited in claim 6, further comprising demodulator  
20 means for extracting data from said estimate of said signal of interest.

8. An apparatus for extracting a signal of interest from a plurality of spectrally and temporally overlapping communications signals containing digital data having a bit rate, said communications signals having carrier frequencies, said communications signals having conjugate cycle frequencies equal to twice  
5 their carrier frequencies plus and minus one-half of their data bit rate, said communications signals exhibiting conjugate spectral redundancy for spectral components having frequencies separated by said conjugate cycle frequencies, said communications signals exhibiting temporal redundancy, said apparatus comprising:

- 10 (a) sensor means for receiving said communications signals;
- (b) filter means for frequency-shifting, time-shifting and polarized switching of said signal of interest contained in said communications signals, wherein said signal of interest is frequency-shifted by an amount determined by its cycle frequencies;
- 15 (c) means for adapting said filter means; and
- (d) means for producing an estimate of said signal of interest.

9. An apparatus as recited in claim 8, wherein said sensor means comprises an antenna and a radio frequency receiver.

10. An apparatus as recited in claim 9, further comprising signal buffering means for buffering an output signal from said filter means and producing and intermediate signal as an input to said adapter means.

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11. An apparatus as recited in claim 10, further comprising matrix-vector multiplier means, coupled to said signal buffer means and said adapter means, for weighting and linearly combining signals from said filter means.

10 12. An apparatus as recited in claim 11, further comprising demodulator means for extracting digital data contained in said estimate of said signal of interest.